

*Observations of Saturn's Ninth Satellite, Phœbe, from Photographs taken with the 30-inch Reflector at the Royal Observatory, Greenwich, in 1907.*

(Communicated by the Astronomer Royal.)

Phœbe has been under observation during the recent opposition of Saturn with the 30-inch reflector, photographs having been obtained whenever possible. In all 16 photographs have been secured on 16 nights, between August 10 and December 6.

From one to two hours' exposure was necessary on account of the faintness of the satellite and its low altitude ( $5^{\circ}$  south of the equator).

The positions of the satellite have been measured on the photographs taken with the reflector with reference to three or four faint comparison stars (of eleventh or twelfth magnitude), symmetrically distributed about the satellite. The positions of these faint comparison stars were then measured relatively to the reference stars (of eighth to ninth magnitude) in the Astronomische Gesellschaft Catalogue on photographs (with  $30^m$  and  $40^m$  exposure) taken with the Astrographic 13-inch refractor. The field, sensibly free from distortion, being much larger with this telescope than with the reflector, from 16 to 20 reference stars were available on each plate.

As Saturn moved slowly, it was possible to make one reference plate serve for several photographs which were each referred to it. The constants were determined in the usual manner, all the stars on the plate given in the A.G. Catalogues being used for this purpose. Right Ascensions and Declinations of Phœbe were then determined and compared with the tabular positions of Saturn after applying to the tabular places the corrections

$$\text{R.A.} + s^{\circ}051 \quad \text{Dec.} + d^{\circ}48$$

as determined below.

*Observations of Phœbe.*

Date and G.M.T.	Apparent R.A.			Apparent Dec.			Phœbe - Saturn			Exp. m	
	d	h	m	s	h	m	s	°	'	"	
Aug.	10	12	55	35	23	50	53.23	-3	34	29.7	-0 27.31
	11	12	39	47	50	41.08		36	0.6		0 28.71
	18	12	39	10	49	7.84		47	44.6		0 38.25
	19	12	53	50	48	53.36		3	49	32.2	0 39.62
	29	11	4	59	46	19.31		4	8	4.7	0 52.53
Sept.	2	10	56	11	45	12.25		15	54.4		0 57.50
	9	11	45	18	43	9.46		30	1.9		1 5.68
	10	11	47	20	42	51.68		4	32	2.2	1 6.74
Oct.	2	10	36	20	36	21.70		5	14	36.1	1 27.68
	4	10	52	26	35	47.97		18	7.7		1 29.11
	8	10	44	28	34	42.92		24	51.1		1 31.83
	12	9	1	36	33	41.99		31	1.8		1 34.22
	30	8	33	44	29	55.18		52	45.3		1 40.62
Dec.	3	6	34	27	28	4.66		56	56.9		1 33.00
	5	6	35	9	28	12.86		55	35.8		1 31.77
	6	6	45	38	23	28	17.69	5	54	49.7	-1 31.04
											-10 30.0

*Errors of Tabular Place of Saturn.*

The positions of Phœbe given above depend on the positions of certain stars taken from two catalogues of the Astronomische Gesellschaft, and will be affected by the mean error in the places of these stars. To eliminate this it is necessary to determine the position of Saturn referred to the same stars.

For this purpose a series of photographs of Saturn was taken with the Thompson 26-inch refractor, using the occulting shutter. With a rather slow plate an exposure of 2 minutes was given to the stars in the field, Saturn being exposed for about  $\frac{1}{100}$ th second every alternate second. In this way a good measurable disc of Saturn was obtained, whilst giving sufficient exposure for the stars.

The field of the 26-inch refractor on a 16 c.m. plate being only 1° square, or a quarter the area of the Astrographic plate, only three or four stars were usually available on each plate, but the positions of these were deduced from measures made on the Astrographic reference plates for Phœbe, using all the stars. The mean systematic error of these three or four stars will therefore be the same as if all the stars had been used, and the position of Saturn deduced will be affected by the same error, and will then be comparable with the deduced places of Phœbe.

Eleven photographs were selected for measurement. From two to four images of Saturn, and of each of the stars, were measured on each plate in the Astrographic micrometer, and the following are the results obtained. The observed R.A. and Dec. of Saturn were computed to 0°.001 and 0''.01 respectively; but as the tabular place in the N.A. is only given to 0°.01 and 0''.1 respectively, the errors are only given to that order of accuracy.

*Errors of N.A. Tabular Place of Saturn.*

		Tab.—Obs.	
		R.A. s	Dec. "
July	24	+ 10.1	- 0.3
Aug.	18	- 9.6	.5
	19	.05	.5
	19	.06	.1
Sept.	9	.09	.6
	23	.08	.5
Oct.	2	.07	.4
	4	.04	.3
	12	.05	.7
	15	.05	.6
	30	- .02	- 0.8
Mean		- 8.051	- 0''.48

*Royal Observatory, Greenwich:*  
1908 January 8.

Day, 1907.	Phenomenon.	Telescope.	Power.	Moon's Limb.	Mean Solar Time of Observation.	Observer.
January 26	Disapp. ν Geminorum	Old Altazimuth ...	100	Dark	6 39 40'12	A. C.
26	" "	Sheepshanks Equatorial ...	100	"	6 39 39'76	J. E.
February 23	ζ Geminorum	Astrographic Equatorial ...	225	"	7 10 30'37	W. S.
23	Piazzi VI. 311	" "	225	"	7 11 40'18	W. S.
23 (b) (c)	" "	Sheepshanks Equatorial ...	100	"	7 11 40'46	J. E.
March 20	m Tauri	Old Altazimuth ...	100	"	9 23 21'42	S. E.
20 (a)	" "	Astrographic Equatorial ...	225	"	9 23 20'59	H.
20	" "	Sheepshanks Equatorial ...	100	"	9 23 21'23	R. C.
21	χ <sup>1</sup> Orionis	Old Altazimuth ...	100	"	7 14 42'47	S. E.
21 (a)	" "	Great Equatorial ...	670	"	7 14 42'57	W. B.
21	" "	Sheepshanks Equatorial ...	100	"	7 14 42'08	J. E.
21	" "	Astrographic Equatorial ...	225	"	7 14 41'89	W. S.
21 (a)	" "	Merz Refractor ...	250	"	7 14 41'92	R. F.
21	B.D. + 19°, 1146	Astrographic Equatorial ...	225	"	9 32 7'46	W. S.
21	B.D. + 20°, 1202	Merz Refractor ...	250	"	10 6 16'43	C. D.
21	B.D. + 20°, 1209	Astrographic Equatorial ...	225	"	10 37 8'75	W. S.
21	B.D. + 20°, 1211	" "	225	"	10 46 22'22	W. S.
21	χ <sup>4</sup> Orionis	Merz Refractor ...	250	"	12 28 49'33	R. F.